# Results of Year 2000 Desktop Computing Investigations

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## ABSTRACT

As part of its Year 2000 Project, DSTO developed a Strategy for addressing the DSTO Desktop Computing environment. This report records the results of the Year 2000 Rollover related investigations of the DSTO Desktop Computing environment, and records the rationale behind the recommendations made by the DSTO Year 2000 Desktop Strategies Working Party and the Strategy chosen and executed by the DSTO Year 2000 Working Group.

**RELEASE LIMITATION**

*Approved for public release*

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# Results of Year 2000 Desktop Computing Investigations

## Executive Summary

In preparation for the possible impact of the Year 2000 Date Rollover, DSTO set up and successfully executed a project with a primary goal of identifying all of its critical and important systems employing information technology, and certifying their fitness for purpose. With this completed, the secondary goal of the project was to develop and execute a strategy to address the possible impact of the Year 2000 Date Rollover on DSTO's Desktop Computing Environment. The strategy was required to address all five levels of the desktop computing environment, viz: hardware, operating system, applications, data and data exchange.

The first stage of the Desktop process commenced in 1997 and involved examining the Hardware and Firmware issues. This led to the development of a process to locate, identify and record DSTO's PCs, and to test their hardware and firmware.

Investigations addressing the subsequent levels of the desktop environment were carried out after DSTO's critical and important systems were certified. By this time (early 1999), much more information about the possible impact of Year 2000 on the desktop environment was available. It was felt that the impact on DSTO's desktop environment was likely to be small but, given the uncertainty of the situation and the amount of effort being devoted to the desktop environment by commercial organisations, it was also felt that due diligence required DSTO to investigate the situation. This report documents those investigations.

As is often the case with such investigations, the results uncovered a range of issues, some of which were not originally envisaged. In brief, these are:
- Operating Systems date parameters
- Software/version inventory
- Data Inventory and Data Management
- Data characteristics
- Functionality and range of available tools
- Inconsistencies in versions of the Java Virtual Machine, and
- Monitoring of the effects of the Year 2000 rollover on file systems.

Each of these is discussed in detail, and a series of recommendations for addressing the issues are presented. This report also:
- summarises the pros and cons of the tools investigated, and
- discusses the way Microsoft Excel handles dates, and mentions some of the unexpected consequences.

The results of the investigations were discussed by the Desktop Strategies Working Party (DSWP), resulting in a series of recommendations to the DSTO Year 2000 Working Group (WG). These recommendations were accepted by the Working Group and used as the basis for DSTO's Desktop Strategy. In summary:

The WP recommended to the WG that the WG make the following recommendations to DSTO users:

1.  It is recommended to DSTO users that on all of its PCs (which use the Microsoft Operating Systems Windows 95, Windows 98 and Windows NT), DSTO use default date display formats which specify 4-digit years.

2.  It is recommended that users continue to check the compliance of COTS (Commercial Off The Shelf) software via the DSTO Year 2000 COTS Compliance Information web page.

The WP recommended to the WG that:

3.  Howard Harvey (of AOD)'s "Short Date" application (which checks and allows setting of the short date display format) be deployed and used DSTO wide to facilitate the setting of the Short Date display format in Windows 95/98/NT to 4-digit-years.
    Deployment will be via SCIS, coordinated by Adrian Pitt (of SCIS Melbourne), and will occur as follows:
    *   SCIS will develop a methodology to deploy the program automatically at all sites. Where automatic deployment is not possible, an alternative strategy will also be developed.
    *   An awareness email will be sent to "DSTO All", addressed to Windows 95/98/NT users, advising them of the problem and SCIS's plans for deployment.
    *   The deployment will then occur.

4.  SCIS to continue with their policy of upgrading / patching affected Microsoft software users only as problems arise, and all regional Help Desks and Divisional Computing Committees be advised of any such problems and their solutions.

5.  A general awareness email on the risks of Year 2000 rollover on Desktop Data will be broadcast to all DSTO users. Concerned users will be invited to approach their Divisional Representative who will use the Microsoft Excel Date Checking tools and one of Howard Harvey's file-date reporting tools to construct a list of potentially risky and/or important data files. These files can then be assembled centrally and checked using one of the commercial tools. It will be stressed that this checking will only address the use of dates; any other existing errors will remain undetected.

6.  Howard Harvey (of AOD)'s "Date Run" program (which can be used to note changes in File date stamps) be made available to Divisions, via the Divisional Representatives, to monitor the possible effects of Year 2000 rollover on Divisional PC file systems.

The WP suggested to the WG that:

7.  The WG may wish to consider the issue of a policy on the use of 4-digit-dates.

With these recommendations approved, a plan to implement the recommendations was developed and executed and DSTO users were advised of "The effect of Year 2000 on your DSTO Desktop Computing Environment" via email and the web page at:
http://y2000.dsto.defence.gov.au/Year_2000/Docs/desktops.htm

The major finding of the investigations was that, once a few issues had been addressed by the WG and SCIS, DSTO could expect Year 2000 to have minimal impact on its Desktop Environment, particularly if DSTO staff carried out the recommendations of the Desktop Awareness Campaign.

Additionally, the investigations disclosed or confirmed that:
- DSTO Desktop Computing Systems make little use of dates.
- DSTO staff make little use of the shared Novell directories.
- The majority of users' data files are not currently active.
- Buying more disk space is cheaper than managing existing disk space.
- DSTO has no policy, human resources or cultural expectation for managing its intangible computer based information assets.

# Author

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*Peter Fisher has worked as a consultant, systems analyst, software developer and project manager in Australia, Holland, the USA, England, France and Mexico. He has also worked as Manager Computer Operations and Support, and as a University Lecturer in Computer Science.*

*Since December 1997 full-time, and prior to that part-time, he has been working as Deputy Head of DSTO's Year 2000 Project, Chair of the PC Test Working Party and the Desktop Strategies Working Party, Secretary of the DSTO Year 2000 Working Group and its various Working Parties, and has been providing technical expertise and advice on Year 2000 PC and Desktop Computing matters to the SA Year 2000 Networking Group, the SA Govt. Business Office, and the Defence Year 2000 Project Office in Canberra.*

*Peter joined the then Software Engineering Group of DSTO's Information Technology Division in 1994, and has worked as a consultant on software engineering and software procurement matters, has been responsible for organising the data collection for research projects, has been responsible for the evaluation of various software tools and methods, and has been investigating methods to improve the ADO's ability to specify and receive the information that it needs for the ongoing maintenance of its software systems.*

*He has a BSc(Hons) in Computer Science. Prior to his Year 2000 involvement, his research interests lay in the area of tools and methods to provide the information required for the maintenance and support of software. Other interests include software acquisition, software systems visualisation, software metrics, software costing and the management aspects of software development.*

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# Contents

# Glossary

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| AED | Airframes and Engines Division (of DSTO) |
| AOD | Air Operations Division (of DSTO) |
| BIOS | Basic Input Output System (of a PC) |
| CD | Communications Division (of DSTO) |
| COTS | Commercial off the Shelf (Software/System) |
| Desktop | DSTO Desktop Computing Environment |
| DSB | Defence Security Branch |
| DSTO | Defence Science and Technology Organisation |
| DSWP | Desktop Strategies Working Party (of the DSTO Year 2000 Working Group) |
| GMT | (The company that developed the Check2000PC program) |
| GPS | Global Positioning System |
| IS | Information System(s) |
| ITD | Information Technology Division (of DSTO) |
| MPD | Maritime Platforms Division (of DSTO) |
| MS | Microsoft (Corporation) |
| NT | Northern Territory (of Australia) |
| PC | Personal Computer |
| SA | (State of) South Australia |
| SCIS | Science Corporate Information Systems (section of SCM) |
| SCM | Science Corporate Management (Branch of DSTO) |
| SES | Scientific Engineering Services (section of SCM) |
| SSD | Surveillance Systems Division (of DSTO) |
| WG | (DSTO Year 2000) Working Group |
| WP | (Desktop Strategies) Working Party (of the DSTO Year 2000 Working Group) |
| WTE | Work Time Expenditure |
| Y2000 | Year 2000 |
| Y2K | Year 2000 |

# 1. Introduction

This report summarises the results of Year 2000 Desktop Computing Investigations, records the events and decisions that led to DSTO's Year 2000 Desktop Computing Policy and Strategy, and records the Policy and the strategy. The target audience of this report includes

- potential auditors of DSTO's Year 2000 Project,
- parties within DSTO and Defence interested to know more about DSTO's Year 2000 Desktop Computing Strategy, and
- parties within DSTO wanting to know more about DSTO's Desktop Computing Environment.

The first draft of this report [Fisher, 1999-09a] was written for the DSTO Year 2000 Desktop Strategies Working Party (DSWP or WP), the aim being to supply the DSWP with information to facilitate a recommendation on Desktop Policy and Strategy to the DSTO Year 2000 Working Group (WG).

Subsequent to DSWP Meeting No.2, the draft was modified [Fisher, 1999-09b] to record the results of those discussions, and updated to target the DSTO Year 2000 Working Group (WG), the aim being to supply the DSTO Y2000 WG with information and advice to facilitate the making of policy. The recommendations in this report were accepted by the WG and became the basis for DSTO's Year 2000 Desktop Strategy.

## 1.1 Definition of "The Desktop Domain"

For DSTO Year 2000 purposes, the DSTO systems domain was divided into four areas:

- Those systems appearing in the DSTO Systems Inventory [DSTO Year 2000 Project, 1997-9].
- Those systems which DSTO uses, but are the responsibility of others.
  (These appear in the DSTO "External Dependencies" Systems Inventory [DSTO Year 2000 Project, 1999].)
- Those Divisional Financial, Planning and Management systems which are not already in the Systems Inventory.
- Other Desktop Computer systems.

It was decided that "Desktop Investigations" should address Divisional Financial, Planning and Management systems (not already in the Systems Inventory) and Other Desktop Computer systems. Hence, reference within this report to "Desktop Systems" and "The Desktop Environment" covers those two sub-domains.

## 1.2 Background

In tackling the Year 2000 problem, the DSTO created an inventory of its information technology dependent systems [DSTO Year 2000 Project, 1997-9], categorised them as Critical, Important or R&D, and certified their fitness for purpose [Landherr, 1998]. Office Automation and Administrative systems of importance to DSTO operations

were included in the inventory. By definition, if a system is not in the inventory, then its failure will not impact on DSTO's operational ability. (Information about the DSTO Systems Inventory can be found at:

http://y2000.dsto.defence.gov.au/Year_2000/dsto_survey.htm)

Notwithstanding the logic of this argument, and the belief of the correctness of it, there were many other organisations devoting considerable effort to Year 2000 remediation of "the desktop environment". There was concern that there just might be "Desktop Systems" within DSTO whose failure could impact on operations, in particular Divisional administrative, planning and management systems.

Accordingly, the DSTO Year 2000 Desktop Strategies Working Party [DSWP, 1999] was set up to discuss the issue, define the domain, develop a strategy and come up with a set of recommendations as to how DSTO should address the issue. This led to a definition of the domain and a work plan, the results of which appear in this report.

The work plan comprised:

- Consider, investigate and define the issues
- Acquire some Year 2000 tools, acquire some data, and evaluate the tools.
- Analyse the results, propose a solution and a method of implementing it.

## 1.3  Structure of this Report

As is often the case with such investigations, the results uncovered a range of issues, some of which were not originally envisaged. In brief, these are:

- Operating Systems date parameters
- Software/version inventory
- Data Inventory and Data Management
- Data characteristics
- Functionality and range of available tools
- Inconsistencies in versions of the Java Virtual Machine, and
- Monitoring of the effects of the Year 2000 rollover on file systems.

These are discussed in more detail in Section 3 of the report. A series of recommendations for addressing the issues are also presented in Section 3.

Section 2 of the report summarises the work plan, and Section 4 presents the conclusions.

Two important parts of this work involved the evaluation of a number of tools, and development of an understanding of the date handling issues of various Desktop software packages, in particular Microsoft Excel. Details of the results of these investigations are presented in two appendices:

- Appendix A summarises the pros and cons of the tools investigated.
- Appendix B discusses the way Microsoft Excel handles dates, and mentions some of the unexpected consequences.

# 2. The Work Plan

The Desktop Investigations process involved several work plans.

The first task involved a preliminary determination of the nature and scope of the problem, and the development of a discussion paper outlining the basic issues and risks, and proposing some strategies for addressing the problem [Fisher, 1999-03].

This paper was discussed within the DSTO Year 2000 Project, revised [Fisher, 1999-05b], and further discussed. It was decided that a Desktop Strategies Working Party (DSWP) would be formed and would meet to discuss the issue and decide the way forward. Working Party members were recruited, an Agenda and issues paper was created [Fisher, 1999-05a], and a meeting was held.

The Minutes of the first meeting of the DSWP [DSWP, 1999-05] can be found at:
http://y2000.dsto.defence.gov.au/Year_2000/Meetings/Desktop_Strategies/minutes01.htm.

The meeting clarified the definition of the scope, defined the domain, discussed the risks, defined a strategy and defined the roles of those involved.

The meeting felt that an appropriate Strategy was:

- A strategy that addresses the "standard" environment in general, and covers Divisional Finance and Administrative systems. This appears to be consistent with the earlier proposal, viz:
    - assume that, with the exception of some Divisional systems, there are no important desktop systems (that are not in the Systems Inventory), and that the additional risk and impact of failure due to Year 2000 is small,
    - validate these assumptions by using one of the commercial "desktop tools" on copies of some selected user environments (e.g. a selection of Divisional Business Managers and Executive Officers) and, (assuming that the assumptions are successfully validated),
    - conduct an appropriate awareness campaign based on the results of the investigations, with the overarching view that "if it's not in the Systems Inventory and not part of the "standard" environment, you're on your own".

The roles of those involved were:

- The role of the Working Group is to approve the proposed strategy and support the investigations by facilitating access to Divisional contacts and data.
- The role of the Working Party is advisory. The Working Party agreed to meet again to review the results of the validation exercise, confirm the policy recommendations and decide on the elements to emphasise in the awareness campaign.
- The role of the Project team is: choose and acquire some desktop tools, set up a test facility, obtain copies of selected user environments, run the tools, analyse the results and present the findings to the Working Party.

Accordingly, the project team drew up a work plan [Fisher, 1999-07], performed the investigations, and wrote up the results [Fisher, 1999-09a] prior to a second meeting of the DSWP.

The Minutes of the second meeting of the DSWP [DSWP, 1999-09] can be found at: http://y2000.dsto.defence.gov.au/Year_2000/Meetings/Desktop_Strategies/minutes02.htm.

This meeting discussed the results of the investigations and the draft recommendations therein, and came up with a set of proposed recommendations for the DSTO Year 2000 Working Group to consider [Fisher, 1999-09b].

The DSTO Year 2000 Working Group considered and accepted the recommendations of the Desktop Strategies Working Party at WG Meeting No28 [Y2KWG, 1999-09]. With this achieved, the plan and timetable for implementing the recommendations was finalised and the plan was executed.

This involved:

- Developing a strategy for implementing the recommendations at each DSTO site.
- Developing a Desktop Awareness Campaign and a set of recommendations to DSTO staff [Fisher, 1999-11]. (These appear on the DSTO Year 2000 web site at http://y2000.dsto.defence.gov.au/Year_2000/Docs/desktops.htm).
- Developing a coordinated timetable across all DSTO Sites.

and finally

- Rolling it all out.

# 3. Discussion of Issues and Recommendations

The issues considered by the DSTO Year 2000 Working Group in defining its policy were:

## 3.1 Operating Systems date parameters

The manner in which many software applications (particularly Microsoft applications) deal with dates is a function of

- the data,
- the system date,
- the display format of the system date and
- the assumptions made by the application.

With Microsoft Windows Operating Systems, if the display format of the system date uses 2-digit years, there can be considerable ambiguity in the way an application may interpret dates.

There are a number of aspects to this; the two most common involve the "windowing method" used by the application, and situations involving the input of date data to the application - in particular via the cutting-and-pasting of data between applications.

"Windowing" is the technique by which an application maps a 2-digit year into a hundred year period, that hundred year period being called "the window". For example, one application may add 1900 to a 2-digit year value, hence mapping the date into the period 1900-1999, whereas another application may map a value less than 31 to the period 2000-2030, and a value greater than 30 to the period 1931-1999. A third application may map 2-digit years to the period 1920-2019, and a fourth may map them to a "sliding window" from "this-year-minus-50" to "this-year-plus-49". See section B.3 for specific examples.

The issues here are the choice of the window, and more particularly, the fact that different applications using different windows assume that other applications are using the same window as they are, and hence interpret dates as being in a century other than the one intended.

The most popular example of this problem is that consecutive versions of Microsoft Excel use different "windows". All versions of Excel store date data internally in the same unambiguous manner[1], and although a date may be input with two digit years, it is stored internally as a number that unambiguously specifies the century. However, a date with two digit years input to Excel 97 will map into the range 1930-2029, while the

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[1] Microsoft Excel internally stores all date data as an integer count of the number of days since a base date, usually 1st January 1900. Dates prior to 1st January 1900 are stored as negative integers. On MacIntosh computers, date data is usually stored as an integer count of the number of days since 1st January 1904. However, there is no confusion between systems because the base date is a parameter of the spreadsheet and date data is automatically converted as part of the process with any data transfer between spreadsheets.

same date input to an earlier version will map into the range 1920-2019. For example, 1/1/25 will be interpreted and stored internally by Excel 97 as 1st January 2025, whereas earlier versions of Excel will interpret and store 1/1/25 as 1st January 1925.

This problem can be addressed, where practical, by displaying dates with 4-digit years, and entering dates with 4-digit years. As many applications pick up their default display format for dates from the system date display format, setting system date display formats to use 4-digit years can reduce ambiguity.

A related problem is that system settings and the way that applications react to them can affect the results of cutting and pasting data between applications. For example, in certain circumstances when the system date is displayed with 2-digit years, 4-digit year date data cut from one application can be pasted as a 2-digit year date and is subject to the interpretation of the windowing method of the destination application. This ambiguity is considerably reduced, and often eliminated, if the system date display format uses 4-digit years.

Unfortunately, setting the date display format by the most obvious method does not always result in the format staying set. Howard Harvey from DSTO's Air Operations Division has investigated this problem, determined the cause, and developed a solution in the form of a computer program.

More information on this topic, and on Howard Harvey's computer program, can be found at:

http://dove.mtx.net.au/~hharvey/Win95App.html#shortdate [Harvey, 1999b]

http://dove.mtx.net.au/~hharvey/shortdate.html [Harvey, 1999-06] and

http://y2k.berkeley.edu:7040/computers/fixpcs/issues/os-date-format.html [DCAES, 1999]


Accordingly, it was **recommended** that:

Howard Harvey's Short Date application (which checks and allows setting of the short date display format) be deployed and used DSTO wide to facilitate the setting of the Short Date display format in Windows 95/98/NT to 4-digit-years.

Deployment will be via SCIS, coordinated by Adrian Pitt, and will occur as follows:

- SCIS will develop a methodology to deploy the program automatically at all sites. Where automatic deployment is not possible, an alternative strategy will also be developed.

- An awareness email will be sent to "DSTO All", addressed to Windows 95/98/NT users, advising them of the problem and SCIS's plans for deployment.

- The deployment will then occur.

Further discussion of the issue addressed the risk, impact, practicality, politics and public relations of the implementation of the recommendation. This discussion is summarised in the Minutes of Meeting #2 of the Desktop Strategies Working Party [DSWP, 1999-09], which can be found at:

http://y2000.dsto.defence.gov.au/Year_2000/Meetings/Desktop_Strategies/Meetings.htm

Independently of these findings, discussions and decisions, an email message on the topic of setting the short date display format was widely circulated on the Internet. The email correctly described the basic situation, but overstated that not setting the short date display format to use 4-digit-years would cause failure of the MS Windows operating systems. Not surprisingly, Microsoft took exception to this. However, rather surprisingly, they chose to dismiss the whole short date display format issue as a hoax, rather than just correct the overstatement. Microsoft carefully, narrowly and correctly stated that the setting of the short date display format does not affect the compliance of Microsoft Windows operating systems, but their statement ignored the fact that the short date display format does affect many applications. Examples of affected applications [Fanberg, 1999] can be found at:

http://www.dateWise.com/short.htm

This particular matter lies within the broader issue of the general use of 2 and 4 digit years in dates, particularly in the IT environment. As general advice, it is suggested that the use of 4-digit-years in places where it matters will reduce the incidence of problems. However, there are many places where date data is only documentary (i.e. for human readability and for identification purposes - the date data is never actually processed by software as a date). In these cases, the use of 2 or 4 digits in years usually doesn't matter. In discussing the matter, some felt that policy on this issue was outside the scope of Desktop Investigations.

Hence, it was **suggested** that:

The WG may wish to consider the issue of a policy on the use of 4-digit-dates.

## 3.2 Software/version inventories, Software "compliance" and Patches

Many of the available "Year 2000 tools" address the issue of "compliance" of software. In general, they do this by constructing a "software and version inventory" for each machine, and then they interrogate the tool's own internal database to provide information on "software compliance". This information often contains guidance on the action(s) required to make the software "compliant". The advice is generally of the form "apply this patch" or "upgrade to this version". Although this is useful, from DSTO's point of view, this checking process is better addressed by other means.

For the users of most vendors' software, the process of determining whether the software is compliant, and what to do about it if it's not, is quite straightforward – the information is available on the vendor's web site. (Note, however, that experience with the Global Positioning System (GPS) week counter rollover in August 1999 suggests that the information provided may not always be as accurate or reliable as one would

wish!)  The DSTO Year 2000 Project has facilitated the information finding process by assembling a list of vendors of the software products used at DSTO [DSTO Year 2000 Project, 1998-9].   Previous and continuing advice is that users should check the compliance of COTS (Commercial Off The Shelf) software used at DSTO via the DSTO COTS Compliance Information web page at:

http://y2000.dsto.defence.gov.au/Year_2000/vendor/compliance.htm

It was **recommended** that:

Users continue to check the compliance of COTS software via the DSTO Year 2000 COTS Compliance Information web page.

Unfortunately, Microsoft has made the process for Microsoft software much more complicated.   Microsoft provides a (free) software inventory analysis tool (for Microsoft software - only) [Microsoft, 1999a] which tells the user which versions of which MS software exist on a PC, and what upgrade action is required.   Experience shows that the information produced, and the action required, for each machine is considerable.  Further, this information seems to be subject to continual updates.

Analysis by SCIS Melbourne suggests that the multitude of frequently appearing upgrades and patches from Microsoft have very little impact on the vast majority of the user population.  With respect to Year 2000 issues, in general, Microsoft software seems to be "fit for DSTO purposes" for the vast majority of DSTO users.  SCIS's approach has been to wait until users encounter problems and then upgrade / patch the affected users.  It would appear that the risk (of not upgrading / patching) is low, the impact is very low, the cost (of upgrading / patching every PC in DSTO) is high and hence, the benefit is negligible.

It was **recommended** that:

SCIS to continue with their policy of upgrading / patching affected Microsoft software users only as problems arise, and all regional Help Desks and Divisional Computing Committees be advised of any such problems and their solutions.

The idea of construction of a Software Inventory has been around for years, but it has never been implemented at DSTO (or many other places).  Presumably this is because it was thought of as a manual task, in which case

- it would be a lot of work to construct the inventory,
- when constructed, the inventory would almost immediately be out of date, and
- it would require ongoing resources to maintain it.

As implied above, one of the more general benefits from "the Year 2000 problem solving industry" has been the popularising of cheap software tools which automatically produce, (almost as a side product), Software (and version) inventories. In the eyes of the industry, the benefit of these tools is to advise you of the level-of-compliance of your software.  From DSTO's point of view, the Year 2000 functionality aspect of these tools is better addressed by other means (see above).

However, one might have thought that with DSTO's focus on The Knowledge Edge, an automatic Software Inventory functionality would be a valuable addition. This matter was discussed by the Desktop Strategies Working Party, and a number of those present questioned this conclusion. The counter-opinion was that DSTO has no business requirement for a Software Inventory. Further discussion was inconclusive.

In a similar vein, the opinion was presented that, given that they currently exist, one might have thought that the ongoing maintenance of the PC Inventory and the Systems Inventory would be important parts of DSTO's Knowledge Edge strategy. It was acknowledged that there had already been some demand for and use of this information. However, the counter-opinion noted that maintenance of these databases was not automatic, it required considerable effort, it relied upon all DSTO staff volunteering information of relevance in a timely manner, and there does not appear to be anyone available (or willing) to do the work.

It was concluded that these two issues would be brought to the attention of DSTO staff working in the Knowledge Management and the Information Operations areas, but that no recommendations would be made on these issues at this time.

## 3.3 Data Inventory and Data Management

Within DSTO (and most of the rest of the world), the cost of additional disk space is much lower than the cost of managing data. This is either because there are no tools available that make the management of data cost effective, or such tools are not widely known. Consequently, a lot of "old rubbish" and multiple copies of information remain on disk because it's just too hard to separate the "good stuff" from the "rubbish".

The "Year 2000 Industry" has supplied us with cheap tools that (as a side product) also automatically produce an inventory of certain classes of files, particularly spreadsheet and database files. (See Appendix A, "Summary of Results of Tool Investigations" for more details.) As can be seen from that appendix, these tools still have their limitations, and I hesitate to recommend their general use for this purpose at this time. However, should tools which use this functionality to address file management as their primary purpose become available, I can see the benefits this would supply in DSTO's ability to manage it's information resources.

As with the previous topics, it was concluded that this issue would be brought to the attention of DSTO staff working in the Knowledge Management and the Information Operations areas, but that no recommendation would be made on this issue at this time.

## 3.4 Data Characteristics

One of the original major purposes of the Desktop Investigations was to determine the risk to DSTO of Year 2000 on DSTO's Desktop Data. An important side effect of the tool evaluations (see section 3.5) has been the construction of a picture of the

characteristics of DSTO's data (or more precisely, the characteristics of the sample chosen).

The collection of data chosen for testing the tools was a large, diverse (and therefore, one hopes), representative sample. For testing the free tools, I chose the complete contents of the publicly visible files on the ITD Salisbury file server, plus the complete contents of the ITD Salisbury administrative, planning and management file storage areas. For testing the commercial tools, (where the licensing agreements dictate that you need one licence for each user's files), I used two licences and classified myself as a Year 2000 Project user, and as an ITD administrator. This gave me access to both the volume and diversity of ITD's administrative, planning and management data, and the large volume of the Year 2000 Project's files. Interestingly, although this gave a large and diverse sample of both large and small files, subsequent analysis showed that few of the spreadsheets were particularly complex, and none of the complexity in the spreadsheets and databases involved dates.

Much to my surprise, although the tools produced voluminous output, analysis of the reports showed a very small set of problems (albeit many occurrences of them). Further, when all instances of the potentially serious problems were examined, only one set of files came up with a situation that may result in real problems.

An important thing to note is that I, alone, was not able to rule out some of the potential problems. It required the knowledge of the "data owner" to look at the highlighted potential problems and state how the data was used, and hence whether the potential would be realised or not.

By way of clarification, nearly all of the potential problems occurred in fields that were only ever looked at by humans – the potentially problematic data was never sorted or used in calculations by the software. Perhaps this is an indication that "real" date data already needed to be correct in order for the software to produce correct results, whereas the "correctness" of "display only" data would only become an issue if a human complained enough to get something done about it. This conclusion was further supported by the evidence that the largest number of potential problems were identified in spreadsheets which were no longer in use (but had not been deleted / archived).

The only set of files that came up with a situation with real potential to cause a problem were the various versions of Time Sheet spreadsheets used within ITD that use one or more of the various Excel DATE() functions. (See Appendix B, "The unexpected consequences of MS Excel Date Handling", for an explanation of these problems). By coincidence, identification of use of the family of Excel DATE() functions (but not use of the DATE() function itself) is the one (only?) truly useful thing that the free batch mode Microsoft Excel Date Checking routines [Microsoft, 1999b] do. (See Appendix A, "Summary of Results of Tool Investigations" for more details.)

**Conclusions:**

Despite these results, I was wary of concluding that, in the area of Desktop Data, DSTO has no real problems. The major reasons for this wariness were:

- Whether a problem is "real" or not can be a subjective, rather than an objective, decision. (You can't leave the decision to an automated tool.)
- None of the complexity in the spreadsheets and databases examined involved dates.
- I actually found one real problem.

Other important points were:

- The majority of files on disks seem either to be old versions kept for historical purposes, or simply old rubbish. The proportion of files that are active now and will be used in the future is quite small. (An automatic ability to classify and filter files as "archive copy", "current file" or "rubbish" would be nice!)
- The free batch mode Microsoft Excel Date Checking tools were a useful starting place, but were not adequate for the whole job. They only examine spreadsheets, they only examine fields formatted as dates, and they don't identify where in the spreadsheets the problems are. (They just note that the spreadsheet has problems or potential problems). Further, they don't give any information that could be used to help determine whether the file is "current".
- The commercial tools examined identify potential date-related problems in all parts of a number of types of file, detail exactly where and what the problems are, and give information like "date file last modified". However, the majority of the potential problems identified seemed to turn out, on manual examination, to not be problems.
- Discussions with Year 2000 Desktop Project Managers from other large organisations based in Adelaide (who were each examining hundreds of thousands of spreadsheets) determined that they were getting similar results (i.e. very few real problems).
- In all cases, it seems to require the "data owner" to review the warnings and data to determine if there are any real problems.

Coming up with a recommendation was difficult. The Desktop Strategies Working Party agreed with the following.

It was **recommended** that:

A general awareness email on the risks of Year 2000 rollover on Desktop Data will be broadcast to all DSTO users. Concerned users will be invited to approach their Divisional Representative who will use the Microsoft Excel Date Checking tools and one of Howard Harvey's file-date reporting tools to construct a list of potentially risky and/or important data files. These files can then be assembled centrally and checked using one of the commercial tools. It will be stressed that this checking will only address the use of dates; any other existing errors will remain undetected.

## 3.5 Functionality and range of available tools

There is a huge range of Year 2000 tools available, and masses of literature about them. Unfortunately, most of this literature either contains no information, or is obviously biased, or is of unknown reliability. Of that which remains, some is conflicting. Hence, choosing a tool is potentially a random process.

I decided to choose a set of tools to evaluate on the basis of size of user base and the opinions of Year 2000 Project Managers based in Adelaide who had made use of the tools. I readily acknowledge that there are a number of other potentially equally good (or perhaps even better) tools available, but my primary focus was DSTO's data, and hence my primary aim was to find a tool that gave a good enough analysis of our data. Secondary aims included useability and price.

The following table gives a brief summary of the tools examined and their functions.

See Appendix A, "Summary of Results of Tool Investigations" for more details.

| | 1<br>Short Date | 2<br>Date Run | 3<br>Analyser | 4<br>Xldate | 5<br>Onmark | 6<br>Norton | 7<br>Paradox | 8<br>GMT |
|---|---|---|---|---|---|---|---|---|
| a BIOS Check | | | | | x | x | x | x |
| b BIOS Fix | | | | | x | | | x |
| c Format Check | x | | | | | | | x |
| d Format Set | x | | | | | | | |
| e Software Inv | | | x | | x | x | | x |
| f Excel Inv | | | | x | | | | |
| g Excel DATE() | | . | | x | x | x | x | x |
| h 2-digit-years | | | | | x | x | x | x |
| i Date issues | | | | | x | x | x | x |
| j Fix errors | | | | | x | | x | |
| k Manual step | | | | x | x | | | x |
| l Free | x | x | x | x | | | | |
| m Commercial | | | | | x | x | x | x |

Tools examined were:
1. Howard Harvey's Short Date Tool [Harvey, 1999b]
2. Howard Harvey's Date Run Tool [Harvey, 1999a]
3. Microsoft Product Analyser [Microsoft, 1999a]
4. Microsoft Xldate toolset [Microsoft, 1999b]
5. Onmark Assess [Onmark, 1999]
6. Norton 2000 [Symantec, 1999]

7. Paradox Remediator  [Paradox, 1999]
8. GMT Check 2000  [GMT, 1999]

Functions of these tools include:

a. BIOS checker. (Tools 5,6,7,8)
b. (So-called) BIOS fixer (5,8)
c. Microsoft Windows (95/98/NT) Short Date Display format check. (1,8)
d. Microsoft Windows (95/98/NT) Short Date Display format set. (1)
e. List of software on machine and information about it's compliance (3,5,6,8) (For 3, this only includes Microsoft Software)
f. Inventory of Excel files giving minimum and maximum date in file (4)
g. Occurrences of use of Excel DATE() functions (4,5,6,7,8)
h. Occurrences of 2-digit-years in Spreadsheet files (5,6,7,8) (Note: NOT 4)
i. Identification of various date issues in Spreadsheet and Database files (5,6,7,8)
j. Ability to automatically fix "errors" (5 basic, 7 sophisticated)
k. Ability to manually step through errors in spreadsheets and let you choose to fix them  (5 automatic fix, 4,8 manual fix).
l. Free (to DSTO), and no restrictions on domain of use (1,2,3,4)
m. Commercial, restricted to local machine or involved network licensing (5,6,7,8)

## 3.6 Inconsistencies in versions of the Java Virtual Machine

Another issue that came to light was the discovery of bugs in the time functions of certain versions of Java Virtual Machines being used by various web browsers on various platforms. Results on Unix and Macintosh platforms were not conclusive (no consistent pattern in errors), but it became clear that Netscape Versions 4.03 – 4.51 on PCs used in half-hour time zones (like SA/NT[1]) have problems. Further, the new DSTO web purchasing system has problems with versions of Netscape in this range.

This issue was brought to the attention of SCIS, and as there was a clear business case for upgrading the version of Netscape browsers, this matter was organised and actioned by SCIS.

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[1] There are three half hour time zones in the world:
   UTC/GMT +3½ hours  (Afghanistan, Iraq, etc.)
   UTC/GMT +5½ hours  (India)
   UTC/GMT +9½ hours  (SA/NT)

## 3.7  Monitoring of the effects of the Year 2000 rollover on file systems

Examination of PC file systems has shown files with strange system dates. Such strange file dates can lead to unexpected behaviour in the operating system, and hence unexpected results. Howard Harvey (of AOD) has developed a program he has called "Date Run" [Harvey, 1999a] which can be used to monitor file dates in a file system.

It was **recommended** that:

Howard Harvey's Date Run program be made available to Divisions, via the Div Reps, to monitor the possible effects of Year 2000 rollover on Divisional PC file systems.

# 4. Conclusions

Although there were reasons for feeling that Year 2000 shouldn't cause DSTO many problems in the Desktop Computing Environment, there was considerable uncertainty. There was concern about the effects on dates in spreadsheets, a general lack of hard information and plenty of external "Fix-it" vendors confusing the issue by adding their opinions of doom and gloom.

Due diligence obliged DSTO's Year 2000 Working Group (WG) to address the topic. Accordingly, a Desktop Strategies Working Party was set up to consider the issues, develop a strategy, recommend a plan of action and, if accepted, execute it.

In the course of this process, in addition to gaining knowledge and some certainty about Year 2000 issues, DSTO gained insight into its Desktop Computing Environment and the way that it is used. Also, some of the findings of the investigations have uses beyond addressing the possible impact of Year 2000.

The major finding of the investigations was that, once a few issues had been addressed by the WG and SCIS, DSTO could expect Year 2000 to have minimal impact on its Desktop Computing Environment, particularly if DSTO staff carried out the recommendations of the Desktop Awareness Campaign.

In contrast to this, the path to determining this conclusion disclosed some unexpected things, and confirmed some other things for which there had previously been no evidence.

These include:

- DSTO Desktop Computing Systems make little use of dates, and where they do, this is mainly for display purposes (only). The systems very rarely make use of dates for calculation purposes.

- DSTO staff members make little use of the shared directories on the Novell file servers.

- The majority of a users' data files are not currently active. Some of these inactive files are kept for historical, archive or audit purposes, but the majority are simply out of date and are of no further use.

- Buying more disk storage is cheaper than managing disk usage. With disk space now below 2c/Mb ($15-$20/Gb) and continuing to get cheaper, there seems little incentive to change this.

- DSTO has no tools or mechanisms for economically managing its data.

- DSTO has no policy or available human resources for managing its computer based information. Currently, other than for Year 2000 purposes, it does not appear to have a business requirement for resources like a software or a systems inventory. Should such a business requirement arise, there would need to be a cultural change whereby all DSTO staff would treat these intangible assets in a manner similar to the way that DSTO treats its tangible assets.

# 5. Acknowledgments

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# Appendix A. Summary of Results of Tool Investigations

## A.1 Howard Harvey's Short Date Tool

### A.1.1 What is it?

A program that checks and/or correctly sets the Windows 95/98/NT Short Date Display format.

### A.1.2 Cost / Restrictions / Supplier

Free / None / Howard Harvey (i.e. local to DSTO)

http://dove.mtx.net.au/~hharvey/Win95App.html#shortdate and

http://dove.mtx.net.au/~hharvey/shortdate.html

### A.1.3 Features / Functionality

- Run program to set the Short Date Display format in <u>all</u> the right places.
- Can be set up to run at system startup to check the Short Date Display format against a previously chosen "default" format. If format doesn't match the "default", warns user and allows user to optionally (re-)set it.

### A.1.4 Pro

- Does the job properly in all the right places, causing the Short Date display format to stay set. (It is often the case that setting the display format via "Regional Settings" only lasts till next reboot.)
- Once installed to run at startup, requires no further effort and is unintrusive.

### A.1.5 Con

- Can't think of anything.

### A.1.6 Conclusion

Let's deploy it and use it DSTO wide.

## A.2 Howard Harvey's Date Run Tool

### A.2.1 What is it?

A program to construct, compare and report on lists files (on PCs) with file dates outside a user specified range.

### A.2.2 Cost / Restrictions / Supplier

Free / None / Howard Harvey (i.e. local to DSTO)

http://dove.mtx.net.au/~hharvey/Win95App.html

### A.2.3 Features / Functionality

Quite a number, allowing flexible analysis of file dates on PC file systems. See documentation for details.

### A.2.4 Pro

- Flexibility
- Good reporting
- Easy to use

### A.2.5 Con

- Can't think of anything.

### A.2.6 Conclusion

Useful tool to monitor the possible effects of the Year 2000 rollover on PC file systems. Deploy to Div Reps for monitoring use on Divisional basis.

## A.3    MS Product Analyser

### A.3.1    What is it?

Microsoft software product and version inventory and compliance information tool.

### A.3.2    Cost / Restrictions / Supplier

Free / None / Microsoft
http://www.microsoft.com/technet/year2k/pca/pca.htm

### A.3.3    Features / Functionality

Scans specified drives for Microsoft software and reports on the compliance.

### A.3.4    Pro

- Easy to use
- Creates an inventory of the Microsoft Software

### A.3.5    Con

- Microsoft Compliance information is continually changing, but the database isn't being updated with the same frequency or speed.
- Most of the patches recommended have no impact on the products' fitness for DSTO purposes.

### A.3.6    Conclusion

Nice idea, but too much hard work to implement the tools suggestions, which may be out-of-date and/or may not make any difference to DSTO.  (Poor cost/benefit ratio.)

## A.4 MS Xldate toolset

### A.4.1 What is it?

An "add-in" to MS Excel 97 / 2000 (only) which addresses date problems in MS Excel (all versions?) files.

(An "add-in", also sometimes referred to as a "plug-in", is something, often externally supplied by another vendor, which you add to an existing piece of software to give it additional functionality.)

### A.4.2 Cost / Restrictions / Supplier

Free / None / Microsoft

http://support.microsoft.com/support/kb/articles/q176/9/43.asp

### A.4.3 Features / Functionality

Three "batch mode" scanning tools

- "Date Fix Wizard" scans for existence of formatted dates.
  (Returns pathname, # cells with dates, highest and lowest date used.)
- "Date Function Wizard" scans for use of the Excel DATE() function.
- "Date Migration Wizard" scans for "other" Excel functions that take dates as arguments.

Other tools to assist the manual repair of individual cells (manually, one at a time).

Can also run tools manually on the "current" spreadsheet.

### A.4.4 Pro

- Can scan network drives from any PC – don't have to be on server, just need to have necessary "read" permission(s).
- Free – No licensing or redistribution problems, or restrictions on the domain in which it will operate.
- Possibly useful as a spreadsheet audit tool. i.e. gives a list of all spreadsheet files.
- Batch Run results concise – low "noise" factor (but, see Con side comments.)
- (Supposedly) Identifies use of the dreaded "DATE()" function (except it doesn't).
- Results presented in a spreadsheet.
- Manual aid tools possibly useful (but, performance degradation.)

### A.4.5 Con

- Only addresses Spreadsheet files.
- Only looks at fields formatted as dates – does not address date-like data in text fields. (Is this sufficient?)

- The "NextFlexPeriod" macro in my timesheet doesn't work when these "add-ins" are active. (I wonder what else doesn't work?)
- Causes normal Excel use significant performance degradation.
- Three separate scan tools – not integrated into one.
- Results report concise BUT, Error Reporting is inadequate – only tells of the existence of errors, not the location or nature of the errors. (Finding instances of problems in big sheets and/or multi sheet files is extremely difficult.)
  - Results of date scan only tell minimum and maximum date found in fields formatted as dates, not the sheet/cell location of the dates.
  - Results of the Date Function and Date Migration Wizards only mention the number of problems, not what or where they are.

  Note, however, that manual tools can be used to locate errors within a spreadsheet.
- Results report concise BUT, does it find the errors? Scan of Year 2000 Project files found NO problems, and rest of ITD_SHR showed very few. Are there really so few problems?
- In this same domain, only one occurrence found of use of DATE() function. Is it really used so infrequently? Later examination showed it found the YEAR() function, not the DATE() function.
- Sheet known to contain DATE() returned NO errors
- For general audit purposes, a tool that handles all files is probably more useful.
- (Minor issue, but irritating.) Results in US formats – date fields and paper size (and rest of spreadsheet) need manual reformatting.

### A.4.6 Conclusion

Batch Mode tools don't really go far enough, and don't always do what they promise.

Manual tools probably useful, provided you can put up with the performance degradation.

## A.5    Onmark Assess / Norton 2000

These two tools appear to be almost identical. Onmark Assess was one of the first and best tools on the scene, and seems to have held its place and reputation.

### A.5.1  What is it?

Single User version: A stand-alone program that scans files on local drives and reports things it thinks are date related problems, giving them a "severity" coding. Also does a software inventory and BIOS check.

Network version available (at a price), which constructs more comprehensive software inventory and has additional functionality, including ability to reclassify error levels.

### A.5.2  Cost / Restrictions / Supplier

Onmark Assess 4.0 single user: $49   Server Edition: $75/PC (negotiable)

(Server edition has additional functionality not in single user version.)

Purchased from

Diamond River Corp Pty Ltd (Barry Liston),

268 Flinders St, Adelaide  SA  5000

Ph: 08 8227 2223

Limited local support – more complex questions answered reasonably promptly via Sydney.

http://www.viasoft.com and http://onmark.viasoft.com

### A.5.3  Features / Functionality

- BIOS check / fix.
- Software and version inventory with compliance advice database.
- Spreadsheet, database and "other" files date scan and reporting.
- Note: not restricted to Excel and Access – addresses a range of companies.
- Optionally create copy of spreadsheet-with-errors and highlight cells with errors.
- Optionally create copy of spreadsheet and fix errors, either automatically or with user approval of each change. They state their fix function is rudimentary.

### A.5.4  Pro

- Finds lots of date related things.
- Addresses a range of spreadsheet and database products, and looks for "dates" in other types of files too.
- Good, tailorable, reporting which classifies the errors, counts them, and identifies where they are. Reports can be switched as concise or (very) detailed.
- Switchable feature which, when on, creates a copy of the spreadsheet and colours the problem cells with a colour appropriate to the severity of the problem.

- Produce appears mature and stable.
- Good user interface.
- Used locally in Adelaide by Santos and Fauldings.
- Local agent seems to provide good support.
- Pricing may be reasonable (i.e. cost / benefit within the realms of reality.)
- Fix function for spreadsheets may be useful – not examined in detail.

### A.5.5 Con

- At first pass, finds too many things, many of which (most?) are false alarms. This does help identify potential problem areas, but report parameters need tailoring before useful reports are produced. (As it happened, I didn't care about any of the things it did find.)
- Fix function does not appear to be very intelligent – not examined in detail; more investigation required if we think we have a requirement here.

### A.5.6 Conclusion

Recommended. Good reporting, once you get used to driving it and tailor it to your requirements. After looking at its reports and your data, you feel confident that you know the status of your spreadsheets and databases. At first, the volume of output is a bit daunting. (Effectiveness of remediation patchy.)

## A.6 Paradox Remediator

### A.6.1 What is it?

In the same market place as Onmark Assess and the GMT Check 2000 tool, but their selling point focuses on its automatic remediation (which is more extensive than Onmark Assess; GMT Check 2000 has no remediation functionality).

### A.6.2 Cost / Restrictions / Supplier

Single user version $145. Pricing flexible – very keen for our business.

Paradox Computer Solutions Pty Ltd

27A Gresham St, Adelaide SA 5000

Ph: 08 8212 8188

Sales Manager: Stan Hirschfeld

Chief Techo / Product Designer / Director: Steve Koop

http://www.paradox.aus.com

### A.6.3 Features / Functionality

Product concentrates on remediation and literature/documentation stresses this. It is not clear what else it does; such other functions are not of importance to the vendors.

### A.6.4 Pro

- Locally developed in Adelaide.
- Being used by Boral and SA Attorney General.
- Responsive to requests for features / functionality we may want. Product under constant development. Very keen to get our business.
- Remediation seems quite powerful (but difficult to assess).

### A.6.5 Con

- Product under constant development – not sure about maturity or stability.
- Product designed for / aimed at the Corporate "centrally managed IS" market place, rather than for the user-off-the-street or the self-managed-user market place.
- User model somewhat counter-intuitive – designed primarily as a technical tool to do a technical job. User, analysis, reporting, and audit considerations are afterthoughts, not a primary part of the design.
- Early version evaluated:
  - Product stability poor.
  - User interface poor.
  - Reporting poor.

- Later versions supplied address these issues to varying degrees with varying degrees of success, but still difficult to use and difficult to assess its effectiveness.

## A.6.6  Conclusion

Might be quite good, but needs a large learning curve investment to understand and use effectively. Given DSTO's lack of dependence in the Desktop environment on date data, additional time investment was not warranted. Remediation looks very good, but difficult to assess. To make this into a "mass market" product, they need to do more work on the user interface and reporting (and stability).

### A.7    GMT Check 2000

The DSTO Year 2000 Project Team evaluated an early version of the product in late 1997 / early 1998 which contained a BIOS check and Software Inventory. It did not fulfil our requirements. Recent version has considerably more functionality.

#### A.7.1   What is it?

Check 2000 is a competitor to Onmark Assess. Covers the same complete range of expected Year 2000 functionality (see below for detail).

#### A.7.2   Cost / Restrictions / Supplier

Numerous versions – the cheaper the version, the more restricted (inadequate) the functionality.

- Free download does partial BIOS test
- $25 version does complete BIOS test and "fix".
- $50 adds software inventory.
- The first serious version is Check 2000 PC Deluxe. We tested V3.1 $99 from Dick Smith.
- Network version available via Novell (bundled in ZENWorks) – similar functionality to "Deluxe", but not restricted to local drives.

http://www.gmt-2000.com.au

#### A.7.3   Features / Functionality

Check 2000 Deluxe comes as two programs:

1) Check 2000 PC Client:

BIOS Check, Short Date Format Check, Software Inventory with advice, and list of data files (all but data file list printable)

You would probably only want to run this program once.

2) Check 2000 PC Data Scanner

i.e. They separate the Data Scanner from "the rest".

Note: They deliberately politically steer clear of automatic remediation.

#### A.7.4   Pro

Comments apply to the data scanner only:

- Can be set up to look at everything. (Absolutely everything including .dll and .exe files.)
- Appears to be the slick, user friendly program you'd expect it to be (though usability of reports is disappointing).

## A.7.5 Con

Comments applying to the PC Client program:

- Check 2000 PC Client program always executes all parts of the program – you can't run just the software inventory or just the data file inventory.
- Can't print the data file inventory.

Comments applying to the Data Scanner only:

- Seems very slow.
- User interface model and reporting seem similar to Paradox Remediator (which I feel are less than ideal).
- Can be set up to look at everything. (Absolutely everything.)
    - Not clear to the novice what it is useful to look at.
    - Takes forever to run if you set it any serious work to do.
    - When I told it to look at everything, it ran for 8 hours and then fell over.
    - When I told it to look at all spreadsheet and database files and embedded code, it ran for 4 hours and then fell over.
    - To make run time more reasonable, I set switches to look at only the first 20 records, to stop looking after it found the first error in the file, and not to look at embedded code.
- Reporting poor.
- No remediation.

## A.7.6 Conclusion

OK. Can be used to do the job, but is very slow (slower than Paradox Remediator which is also doing remediation, not just checking) and reports are not particularly useable. Doesn't seem to be as easy to use as Onmark Assess, and it is not clear which options to chose when setting up. Onmark has more features, is cheaper, is easier to use, is tailorable, has much better reporting, and is much, much, much faster.

# Appendix B. The unexpected consequences of MS Excel Date Handling

The articles copied below summarise the sort of issues that arise from the assumptions that Excel makes about data and dates. Numerous other examples and articles abound. If you find an article that summarises the situation better, or points out other issues, please bring it to my attention.

Many of the examples that get quoted on this topic involve unusual use of dates; i.e. most people don't use dates in those ways, and hence those examples are rarely of relevance.

The more likely-to-occur examples involve ambiguity and the use of 2-digit-years. In my mind, the majority of ambiguities will occur with dates in the period 1/1/2001 to 12/12/2012, with a lesser number occurring until 31/12/2031 (and most of these ambiguities will disappear if 4-digit-years are used). For example, 1/2/3 could be any one of 1-3 Jan-Feb 2001-2003, (and maybe 1901-1903 too, if you want to be pedantic). However, ambiguity with 1/2/2003 is a function of continent, and 2001/2/3 is unlikely to be ambiguous.

The obvious way to avoid the majority of problems is to explicitly use 4-digit-years. However, as I mentioned in an earlier section of the report, a significant amount of date data is never processed by computers and is there for human visual consumption, in which case such ambiguity is common practice and, in general, doesn't matter. In an attempt to put some perspective on the problem, it should be noted that there are many spreadsheets "out there" containing undetected errors that have nothing to do with dates, and this has a much greater impact than date ambiguities.

## B.1 "PC Applications Data" by Robert Lefkowitz

Robert Lefkowitz is a founding partner in Next Era Consulting Corp. based in New York, a consulting firm created to assist both large and small businesses with information technology solutions, particularly those associated with the Year 2000. A copy of his biography can be found at:

http://www.wbn.com/y2ktimebomb/Bios/rlbio.htm.

This article appears on the Westergaard Year 2000 web site at:

http://www.wbn.com/y2ktimebomb/IT/RL/rl9822.htm

PC Application Data - Part I

By Robert Lefkowitz

June 4, 1998

While I've written about the dangers of using noncompliant PC applications, I have not yet addressed the dangers of noncompliant PC Application Data. Nearly every company has one spreadsheet or another deployed across their enterprise and usually multiple PC database applications. It is not simply enough to replace your noncompliant spreadsheets/databases with newer versions. The compliance of these applications hinges on your usage. An example using Microsoft Excel for Microsoft Office '97 follows:

1. Create blank worksheet.
2. Type "April 95" into cell A1.
3. Type " 'April 95" into cell A2. {note that the apostrophe before the month formats the field as text}. Before any arguments are raised as to the likelihood of the data being entered in this manner, remember that the data could have been entered via a text field, an import of information, typing over another formatted cell, manual formatting override of a column of cells, etc.
4. Type the formula "=Year(A1)" into cell B1.
5. Type the formula "=Year(A2)" into cell B2.

   Cells B1 and B2 both display the Year "1995". If you place your cursor over cell A1, on the formula line, it will register 4/1/1995 (or 4/1/95, depending on the configuration of your computer)

   If you place your cursor over cell A2, on the formula line, it will register 'April 95.

6. Change the year in cell A2 to 02.

Cell B2 now reads 1998. Is that what you were expecting? You might have expected 2002; if you thought that I was trying to lead you astray, you might have expected that the result would be 1902. Where did 1998 come from? Well, Excel made the assumption that since you typed a number lower than 31, that you were actually typing in the month and day of the month, rather than the month and year. With no year data, it simply assumed that the day and month were from the current year, 1998.

7. Change the data in cell A2 to April 29.

Cell B2 still reads 1998 because once again, Excel thought thatyou intended April, 29, 1998.

8. Change the month in cell A2 to February.

Now cell B2 reads 2029. This is because Excel knows that there is no February $29^{th}$ in 1998, so it assumes that you meant February in XX29. Since you didn't specify the century, Excel assigns one for you. Microsoft Excel for Office '97 uses a windowing method to determine an ambiguous century. The window in this version of the product pivots at the year 29. This means that 29 is assumed to be 2029, but numbers greater than 29 are assumed to be from the $20^{th}$ century (1900s).

If you were using a previous version of Microsoft Excel, the year displayed in cell B2 would be 1929.

Warning!!!! The danger in storing dates in text fields is that they are interpreted on the fly as their data is used. Unlike dates stored in date formatted fields, this information is not stored unambiguously - it is stored as you see it on your screen. When the data is required by another cell, it is interpreted as though it is being typed into the cell at that time. This means that the results of Step 8 will be different in the Year 2000 because February $29^{th}$ is a valid date in that year.

The reason for the errors that I've illustrated above are two-fold. First of all, dates have been stored in a non-date format. Second of all, the years were not explicitly specified in four digit format. Next week I'll delve into this topic in greater depth as we discover some additional pitfalls hidden in your application data.

**The Excel DATE() command**

... errors in spreadsheets using the DATE() command incorrectly. That command combines arguments for the day, month, and year into a single date. The command, in order to remain consistent with earlier versions of the spreadsheet, accepts years as an offset from 1900. This means that DATE(02,02,02) is resolved as February 02, 1902. In order to obtain a 21$^{st}$ century date, an offset of 100+ must be used (DATE(102,02,02) yields February 02, 2002). A common error with that function is to simply utilize the last two digits of the year as the first argument. While that works for 20$^{th}$ century dates, it will not work for 21$^{st}$ century dates.

## B.2 "Excel Date Problems Summary" by Brett Bridger

From: "B. & P. Bridger" <bridger@bpbridger.com.au>

To: "'year2000-discuss@year2000.com'" <year2000-discuss@year2000.com>

Subject: Re: Excel

Date: Wed, 22 Sep 1999 10:39:06 +1000

First the easy one - Macintosh based Excel cannot display dates previous to 1904. IBM type PC based Excel cannot display dates previous to 1901. No SR, etc, will fix this. It is a limitation of the operating system that Microsoft has chosen to honour in their product. Until they see a need To re-write their product, and accept a (probably) noticeable performance Hit this wont change. It would also require a new format for the actual .XLS file, so I would never expect such a change except in a new version. Of course, they (Microsoft) did make it a little harder for everyone by allowing you to specify in the setup of the sheet what date system you are using. This means that you can use the PC date system on the Macintosh & the Macintosh system on a PC!

Secondly, copied and pasted dates are simply a problem. If the application that you "cut" the dates from is not displaying a 4 digit date then there is a chance that the application you paste the date into will misinterpret the date. This is dependent upon the application you cut from, the one you paste too and whether or not the application/spreadsheet/etc is still open when you paste. I'm not aware of any changes to this functionality in either SR.

Thirdly, the performance of the DATE function. After a quick look at the Microsoft site, the following errors are listed as still unresolved (for Excel 97/98)

Excel treats 1900 as a leap year -
http://support.microsoft.com/support/kb/articles/Q181/3/70.ASP

Macros in Excel may not detect that the 1904 based date system is being used -
http://support.microsoft.com/support/kb/articles/Q157/0/35.asp

Days of the week prior to 1-March-1900 are wrong (because of first Problem listed here) -
http://support.microsoft.com/support/kb/articles/Q106/3/39.ASP

Importing a 1904 based spreadsheet into Access may cause dates to be out by 4 years + 1 day
http://support.microsoft.com/support/kb/articles/Q103/9/96.asp

Edate function doesn't handle non-leap year centuries under some circumstances -
http://support.microsoft.com/support/kb/articles/Q179/5/83.ASP

EOMonth function doesn't handle non-leap year centuries under some circumstances -
http://support.microsoft.com/support/kb/articles/Q179/5/45.ASP

Brett Bridger

B. & P. Bridger Pty. Limited

This opinion is offered in good faith, but, of course, no liability can be accepted, etc, etc.

## B.3 "Y2000 and Spreadsheets" by Patrick O'Beirne

Patrick O'Beirne is Managing director of Systems Modelling Limited based in County Wexford, Ireland. A copy of his biography can be found at:
http://www.sysmod.com/pobbiog.htm

This article appears at: http://www.sysmod.com/y2ksprds.htm

Last updated 1999-08-24 by pobeirne@sysmod.com

Year 2000 and Spreadsheets
Tips, Traps and Answers to Frequently Asked Questions (FAQ)
By Patrick O'Beirne

1. Don't panic. All spreadsheet products I know can handle dates in both the 20th and 21st centuries - you just have to know how to do it. One bank user got upset doing long term projections by typing in dates and did not notice that it took 1/1/21 to mean 1921 and gave wrong results in his calculation. The good news is that as long as you stick to simple date entry, the spreadsheet will mostly do as you would expect. This FAQ covers most of the "gotchas". The most serious is probably the DATE() function, see below.

2. The safest course as a USER is to be Y2K compliant in entering dates as /yyyy instead of /yy, and to set your Windows Control Panel to a yyyy format (but see #8 for precautions). If you use /yy, you must be aware of what assumptions the software is making as to what century it belongs to. The most common assumption is "windowing": if you enter a two-digit Year less than, say, 20, the spreadsheet assumes you mean 20xx, otherwise 19xx. There is no means within Excel to alter the pivot point of these windows, but Windows 98 and Windows 2000 allow the user to change the pivot point for Office applications.

3. In Lotus 1-2-3 97, the date window is 1950-2049, though it can be enabled or disabled through User Preferences. If you enter only two digits for the year, using the default setting, the year will be stored in the form 19xx for years greater than or equal to 50; it will be stored as 20xx for years less than 50. Earlier versions of Lotus 1-2-3 do not use windowing. All of its dates start at 00 (1900). If you enter 101, it interprets it as 2001.

4. Other Lotus users report: "Lotus 1-2-3 v. 5 & earlier doesn't support four digit years, despite what IBM says! You can't get a date entry to display 19, even if you type a 4 digit year. Lotus 1-2-3 Release 4 doesn't allow you to enter 19xx, rather it requires entry of a two digit year for dates with a century of 19. but release 5

allows you to enter a 2xxx or 1xxx date. There are only two conditions for which Lotus 1-2-3 97 will allow the entry of two digit years:

a.  The short date style in Windows Control Panel must be set to a two digit year (possibly an unpopular option since many applications will require it to be set to one of the four digit year formats).

b.  The date must be entered using one of the valid Lotus two digit year date formats. For example, 31-Dec-96   Dec-96   December-96   96/12/31 96/12 96.12.31 "

5.  Lotus 1-2-3 v.5 @YEAR() function returns the year as an offset from 1900, consistent with the use of a two digit year in the @DATE() function. Therefore, the function returns 100 from a cell with a date in 2000. Excel's =YEAR() function returns a four digit year.

6.  Whenever you enter something in a cell, Excel tries to interpret what you have entered as number or text. If it cannot interpret what is entered as a date, it stores the entry as text. If what is entered could be a date, even if it is only part of a date, such as 1/98, Excel translates it to a number and stores that in the cell. The two-digit year entered is NOT stored as it was entered. Instead, at the time of entry, and according to the current date windowing assumptions, the 2-digit entry is converted to a serial number corresponding to the number of days since 1/1/1900. This number is then displayed in a date format which depends on your current program defaults. You can override the default format. Try applying General format, and you'll see the underlying serial number. Apply your own date format - and you are free to confuse yourself by choosing a two-digit format if you wish - and that format is used.

7.  Excel tries its best to be intelligent about parsing (interpreting) an entry. Anumber greater than 12 cannot be a month; a number greater than 31 cannot be a day, so Excel may switch around its parsing of the parts of a date to make it fit. Assume a Windows date setting of dd/mm/yyyy. A partial date of 01/01 is treated as 01-Jan of the current year. A date of 01/12 is interpreted as 01-Dec. But 01/13 cannot be a day/month, so it is treated as month/year, i.e. 01-Jan-2013. The same applies to 01/99, but 01/00 is left as text because Excel does not recognise 00 as a valid month, and relies upon it being greater than 12 to be interpreted as a year. However, 1/2000 is accepted as 1-Jan-2000. Similarly, with a Windows date setting to yyyy/MM/dd if you enter 1/1/97 in a cell, Excel interprets it as text. If you enter the incorrect date 29/02/01 into a cell (2001 is not a leap year), Excel will treat it as 2029/02/01, i.e. it will treat the 29 as a year. Similarly for 31/04/01. If you use an American date format of mm/dd/yy, then other combinations are possible. It may work fine now to use partial dates like

04/98, but try to get into the habit of using four digit years to avoid utter confusion in future.

8. A useful measure is to change the "short date" format in Windows Control Panel to /yyyy. (Warning: this may cause problems in applications in, for example, Visual Basic, that get the system date as text and expect the year to be in positions 7 and 8 of the string!) Then all entries in Excel and other office products will appear in four digit year format by default, making it very plain to the user what their typing is being interpreted as. Be aware that doing that means that dates will now most likely appear as ##### in the spreadsheet columns with the default column width and character font. You must expand the column width to see the full date. Excel 97 expands column widths to fit dates automatically. Excel version 5.0C does not have a format option for YYYY . You must create your own custom format.

9. The =DATEVALUE(text) function interprets a text argument the same way as data entered from the keyboard. It uses the Windows date format as described in (6) above. Not only that, Excel will attempt to treat any reference to a cell containing a text entry that looks like a date, as a date. This poses a risk in that different versions of Excel will apply different windows to the conversion. So the same spreadsheet loaded into different versions of Excel could give different answers if the dates were calculated from text values. To see the effect, you will probably have to force a recalculation by editing the text cell or using the undocumented keyboard shortcut of Ctrl+Alt+F9. To see differences between Excel Datevalue() and that in VBA, see para #20 below.

10. The =DATE(y,m,d) function does not use the same windowing behaviour as the rest of Excel. It takes three parameters - year, month, day. If you specify all four digits for the year, you can get all dates from 1900 to 2078 (Excel's maximum). If you use two digits, it will always assume 19xx. If you use three digits, then 100 gets you 2000 to 178 for 2078. See above for the YEAR() function. MS Knowledgebase article ID Q214331 "DATE Function Behaves Differently in Microsoft Excel 2000" states: if the DATE function uses a year that is earlier than 1900, Excel adds 1900 to the year argument. If a workbook is using the 1904 date system and if the DATE function returns a date from 1900 through 1903, the function returns a #NUM! error value.

11. You may think that all you have to do is Edit Find =date(). But the =date() function, or indeed any function, may not be easily found in all its guises. A user could define a name that embeds a function call. To see the effect, simply select the menu Insert Name Define , enter a name "test" and Refers to:"=date(00,01,01)". Now enter =test into a cell, and you get 1. Now see if your favourite spreadsheet scanner finds that one! (Thanks to Allen Falcon of IST Development Inc. and ZDnet)

12. If you use the WEEKDAY() function to determine the day of the week of February 16, 1900, Microsoft Excel will return 5, which indicates that the 16th was a Thursday. The function should return 6, because February 16, 1900, was a Friday. (MS PSS ID Number: Q106339) See #16 below for the reason: Excel treats 1900 as a leap year.

13. In Microsoft Excel, the YEARFRAC function does not recognize leap years, such as 1992, unless the leap date (for example, 2/29/92) is between the starting and ending dates. (MS PSS ID Number: Q89031)

14. When (from Microsoft Excel for Windows or OS/2 or from Lotus 1-2-3) you open a previously saved Microsoft Excel file and find that all date entries are four years and one day less than they should be... The problem most likely occurs when the file originated from a version of Microsoft Excel for the Macintosh prior to Version 2.20. (MS PSS ID Number: Q32712) A possible workaround is to save the data as CSV with four digit years and then re-import.

15. Dates prior to January 1st 1900 can not be represented in an Excel spreadsheet except as text. Excel will display the number 0 as January 0th, 1900. Quattro Pro's date functions support a Julian system of dates from 3/1/1800 through 12/31/2099. The actual contents of the cells is an integer value, referred to as a date serial number. This number will range from -36463 through 73050, day 0 = Dec 30, 1899.

16. Lotus 1-2-3 incorrectly treated 1900 as a leap year, and Microsoft perpetuated the error in Excel for reasons of compatibility. If you import an Excel spreadsheet with 29/2/1900 into Access, Excel dates Feb 28, 1900 (day value 59) and Feb 29, 1900 (day value 60) are interpreted by Access as Feb 28, 1900. Day value 61 (Excel Date Mar 1, 1900, but actually Mar 2, 1900) is interpreted by Access as Mar 1, 1900. If you import an Excel spreadsheet into Quattro Pro, you get proper alignment of dates AFTER Feb 28, 1900. Perhaps the starting date in Quattro Pro was chosen to account for the bug in Lotus and Excel.

17. Copy and paste between applications is safe where the underlying serial-number data is preserved. But when transferring between different applications using two digit year display formats, it's possible for different windowing interpretations to clash. If you display dates before 1929 with two digit years, and copy and paste that data from one Excel 97 workbook into another, the result you get depends on whether the originating workbook is opened or closed! If open, the internal data is copied correctly; if closed, the display data is copied, resulting in the window of 2000-2029 being applied thereby increasing the data by 100 years. The workaround: Don't close the first workbook until the date is pasted

into the other workbook. If you've already encountered the problem, correct the dates manually. Search Microsoft's Technical Support Knowledge Base for this item's source, article Q179584

18. Comma Separated Values (CSV) and other text output formats depend on the user's chosen display format for dates. That means that a Windows date format of "dd/mm/yy" causes internally compliant dates to be saved as text with two digits, losing the century digits. Consider the following scenario: An MIS staffer at Head Office using the latest (of course) Excel version prepares an Excel forecast for the other offices. Knowing that they have older versions of Excel, and other spreadsheets such as Lotus 1-2-3, Quattro Pro, VP-Planner, MS Works, etc, he decides to save the data in CSV format. The dates include 2019-01-01 and 2020-01-01. Not being Y2Kaware yet, the HQ expert uses dd/mm/yy format, and the dates get saved as 01/01/19 and 01/01/20. User7 using Excel 5 with dd/mm/yy format, reads it in and does not notice that the last figure was interpreted as 1920-01-01. User20 using Excel 5 but smart enough to use yyyy-mm-dd format is in a hurry and did not see that it interpreted those dates as 2001-01-19 and 2001-01-20.

19. Data exchange layers are a risk. Excel (compliant by MS's definition) can be exchanging data with Informix (also compliant by Informix's definition) but the VBA code driving the SQL calls to the ODBC layer in between could be using two-digit dates. The safest data exchange format is the dBase file format, provided your data is either Character, Numeric, Date, or Logical. But it only suits regular row & column database structures, not report-type layouts with blanks and irregular columns and variable width text. The first header row must be variable names conforming to dBase rules - unambiguous in the first 10 alphanumeric characters. The first row of data, crucially, must be formatted with the way you want the .DBF file to be created - column width, number of decimal places, text width. Date formats create real eight-digit YYYYMMDD dates. So it's easy for a programmer to do this, but the ordinary end-user has only one recourse for plain text data interchange format - set the display format to four-digit years.

20. Of course, spreadsheet users might have been entering data and formulas, or even "power users" writing macros or VBA code, that processes dates in a non-compliant way. An example of a difference between VBA date processing and Excel's own is as follows. In a blank sheet, ensure you can see cell A4, enter the formula into cell A5: =DATEVALUE(A4) and finally enter the following code and execute it:

```
Sub InputDate()
    Dim dDate As Date
    Dim str As String
    str = InputBox(prompt:="Enter a date :")
    ActiveSheet.Range("A4") = "'" & str
    dDate = DateValue(str)
    MsgBox "You entered: " & dDate
    ActiveSheet.Range("A6") = dDate
End Sub
```

In Excel 5.0 you can enter "28 Feb 00" and get 28/2/2000 in A5 from the Excel DateValue but 29/2/1900 in A6 from the VBA Datevalue! Excel 95 (version 7.0) treats 1/1/20 as 1920 from Excel's DateValue but 2020 from VBA's DateValue which uses OLEAUT32.DLL version 2.20.4049 or later. Excel 97 converts the dates consistently.

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If you think of every individual spreadsheet as an application that needs to be checked, you could have a lot of work ahead of you.

DateSpy from Rigel Desktop Solutions will locate and assess Excel spreadsheets. It will locate all versions and will analyse up to Excel 8.

Further information available from http://www.datespy.com

DateSpy Fixer has been announced at
    http://www.year2000.com/releases/NFtools03_02_1999.html

Other products that can scan spreadsheets are Assess from Viasoft http://www.viasoft.com (same as the Symantec Norton 2000 product) and GMT Check 2000 for Greenwich Mean Time at http://www.gmt-2000.com

A comprehensive link of other spreadsheet and database analyzers and Remediation tools is maintained by Datewise at: http://www.datewise.com/linksto.htm   Datewise produce Abater for Excel. This is a general purpose file comparison tool that can be used to find all identical (and nearly identical) spreadsheets. It can be used in advance of making mass changes to spreadsheets for whatever purpose - Y2K, Euro, company restructuring - to avoid redundant effort.

For general info on Excel bugs, see ZDNet's TipZone
www.zdnet.com/zdhelp/bug_help/bugs/bugalert_excel.html

Also see BugNet: www.bugnet.com

Microsoft's position is that its products are almost all "Year 2000 ready", which means that you can operate them safely, but if you don't, it's your problem. See http://www.microsoft.com/year2000. Below is a chunk from the MS Website. Microsoft do not document clearly in the USER documentation what the window is. Ordinary users should not have to buy a Technet CD or go to a Web site to get documentation on such basic interface behaviour.

From the Microsoft Year 2000 web site:

Microsoft Products that Store or Manipulate Dates Year Limit

Microsoft Excel 95 ("YYYY" year) 2078

Microsoft Excel 95 ("YY" year) 2019

Microsoft Excel 97 ("YY" year) 2029

Microsoft Excel 97 ("YYYY" year) 9999

Microsoft Excel versions 4, 5, and 7 all interpret "00" to "19" as short cuts for "2000" to "2019." Microsoft Excel 97 interprets 2-digit years from "00" to "29" as "2000" to "2029" and the short cut "30" will resolve to "1930."

There is an add-in from Microsoft called Datefix that allows you to change the date format of two-digit-year dates quickly and easily or to modify serial number dates so that they fall within a specified century.
http://support.microsoft.com/download/support/mslfiles/Datefix.exe

The Date Migration Wizard handles specific kinds of dates that are in workbooks created in earlier versions of Excel. These dates use years that are two-digit numbers between 20 and 29.
http://support.microsoft.com/download/support/mslfiles/Datemig1.exe

The Date Watch Wizard changes 2 digit years into 4 digit years at the time of entry.
http://support.microsoft.com/download/support/mslfiles/Datewtch.exe

For Microsoft Excel 97 for Windows

The primary page, from which you can download the add-in wizards and read summaries of their functions:

XL97: Year 2000 Wizards for Microsoft Excel 97

Article ID: Q176943

http://support.microsoft.com/support/kb/articles/Q176/9/43.asp


For Microsoft Excel 98 for Mac OS

The primary page, from which you can download the add-in wizards and read summaries of their functions:

L98: Year 2000 Wizards for Microsoft Excel 98

Article ID: Q193344

http://support.microsoft.com/support/kb/articles/q193/3/44.asp


For further information: email pobeirne@sysmod.com

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19. ABSTRACT

As part of its Year 2000 Project, DSTO developed a Strategy for addressing the DSTO Desktop Computing environment. This report records the results of the Year 2000 Rollover related investigations of the DSTO Desktop Computing environment, and records the rationale behind the recommendations made by the DSTO Year 2000 Desktop Strategies Working Party and the Strategy chosen and executed by the DSTO Year 2000 Working Group.